3R-BioPhosphate Ltd.

Established 1989 as Swedish-Hungarian joint venture (HU10254073),
Lang Machine works (since 1870, ALSTOM subsidy)

3R-Biofarm Upcycling Centre, **Industrial site & laboratory:** H-2472 Kajaszo, Biofarm Road 58/3, Hungary (M7 highway West 33 km, Google maps **https://goo.gl/maps/wHxmZ7J1ChJ2**)

Agri conference site: H-2472 Kajaszo, Biofarm Road 58/3, Hungary

Post address: H-2472 Kajaszo, Pf.1 Biofarm, Hungary

Web: **https://www.BioPhosphate.net**
https://www.3rbiofarm.com

Contact: Edward Someus CEO (recycling & upcycling engineer)

Email: Edward.someus@gmail.com biochar@3ragrocarbon.com

Skype: edwardsomeus

Tel 0036 20 8054727, 0036 20 2017557

EU PIC Code: **999693447**

CEO, owner & key tech designer: Edward Someus (upcycling engineer)

The 3R (Recycle-Recover-Reuse) is a technology-intensive company playing a leading international role in commercial up-cycling of agri/food industrial by-products and water treatment adsorbents by unique zero emission pyrolysis and other advanced/innovative integrated technologies for high added value material recovery in economical industrial scale and performance. Unique specialization: ABC animal bone char processing and applications for biofertilizer and water treatment adsorbent.

CORE COMPETENCES:

a) **Nutrient recovery** for ecological farming applications in line with the circular economy;
b) Development and implementation of **Phosphorus recovery technologies and products**, Phosphorus reuse applications, LCA and CBA, market evaluations in the EU, USA and Australia;
c) **3R zero emission pyrolysis technology** and recovered nutrients combined formulations, incl. all elements from science into full industrialization value chain under market competitive conditions;
d) **EU policy knowledge and policy support**, including Circular Economy, Green Deal, EU Fertilising Products Regulation (EU 1009/2019), EU Critical Raw Materials, REACH and Authority permitting of processing technologies & bio-based products;
e) **Standardization and EU law harmonization of innovative fertilizer products** in economically important European dimensions.

3R-BioPhosphate Ltd. “3R” (former name Terra Humana Ltd.) is a science & technology intensive company with core competence of applied scientific RTD and industrial engineering of nutrient recycling and reuse from unexploited agricultural and food industry by-product streams, most importantly Phosphorus recovery. The applied technology is the innovative 3R zero emission pyrolysis technology and combined biotechnological formulations, incl. full production and product application value chain RTD, industrial engineering, scale up and full industrial/market valorisation. The BioPhosphate product having horticultural application permit to lawfully market and commercialise: MS Authority permit 6300/2407-2/2020. The company also received Authority permit for organic phosphorus recovery plant full industrial installation and operation in West Hungary at 3R-Biofarm Upcycling Centre.

The company was established as a Swedish-Hungarian joint venture in 1989 (ALSTOM Power subsidy) and became an independent company in 2001. Since 2002 3R-BioPhosphate Ltd. has coordinated multiple international research and development programs in the specific field of carbon refinery and Phosphorus recovery. 3R is the original source and inventor of “3R” Recycle-Reduce-Reuse zero emission advanced pyrolysis technology. The 3R development has been financed by the company until 2002. From 2002 the European Commission selected the technology and co-funded the further developments through large scale EU research and development programmes.

Based on the past years extensive applied research activity in ten EU Member States with large number of academic and industrial partners, by 2023 TRL6 “TRL” Technology Readiness Level with high research-maturity reached and significant progress made towards market uptake. The flagship project of the company is recovering Phosphorus (BioPhosphate) recycled natural organic fertilizers and its BIO-NPK-C formulations made from agricultural and food industrial by-products for organic and low input farming applications.

The owner and managing director of the company is Mr. Edward Someus, a senior Swedish recycling & upcycling industrial engineer with core competence and specialization on industrial pyrolysis, carbon product development, Phosphorus recovery from animal by-products and marketing of such products in the agricultural and environmental industrial sectors as adsorbent. Mr. Someus is also involved in European Commission standardization and law harmonization as a consultant for revision of the EU Fertilising Products Regulation in the area of phosphorus, biochar, struvite and ash products for the use of innovative fertilisers.

The company **mission is to develop, engineering design, industrial equipment manufacture and full scale production apply novel bio-waste and biochar based technologies** and organic waste treatment systems in economical industrial scale for market competitive applications.

3R-BioPhosphate Ltd. is the only one biochar vendor in Europe, with specific technology and accredited Authority permit under the united EU and Member State regulation to use qualified and eco-safe ABC-BioPhosphate product in open ecological soil environment (permit number 6300/2401-1/2020). During the past two decades the company put in huge human and financial efforts to develop innovative eco-industrial advanced solutions, design, implement and tests “product like” field plants to meet **SME specific market demands** in the EU, Canada, USA, Australia and Japan.

Extensive scientific and SME industrial networks developed in 10 EU countries and in Australia with large number of RTD partners, Universities, large institutions, SME users, farmers and large

industrial organizations. The SME Company is having advanced and well equipped research, laboratory and field test facilities in West Hungary at the BIOFARM and extensive SME cooperation on international level.

3R has established links with several national and international horticultural associations that will provide opportunities to reach stakeholders, including wholesale fertiliser trading companies, large farmers, organic fertiliser producers, producers' organisation, agricultural advisory services, public authorities, national authorities, ministries of agriculture, and chambers of agriculture.

The 3R pyrolysis pilot demonstration equipment has been successfully operated since 2004. In 2025 economical throughput production capacity of 20,800 t/y nominal capacity targeted by implementation of the full industrial TRL9 replication model, that providing 12,500 t/y 30% P_2O_5 content ABC- BioPhosphate output products and bio-energy.

3R-BioPhosphate Ltd. targets to enter the global market with its breakthrough technology and offer an innovative recovered organic phosphorus fertilizer as an alternative of currently used mineral phosphate fertilizers delivered from rock phosphate. While the existing supply channels, user habits and market conditions are valid obstacles to achieve significant share in field agriculture, the organic horticultural and the low input agricultural sectors are a significant and rapidly growing open markets for the ABC-BioPhosphate recovered phosphorus fertilliser.

EU references:

- http://ec.europa.eu/programmes/horizon2020/en/news/making-green-organic-fertiliser-bones
- https://cordis.europa.eu/project/id/289785
- https://cordis.europa.eu/docs/publications/1166/116632181-6_en.pdf
- https://cordis.europa.eu/project/id/NNE5-363-2001
- https://cordis.europa.eu/project/id/NNE5-363-2001/results
- http://phosphorusplatform.eu (member list, REFERTIL)

Membership in platforms/organizations/associations (EU/regional level):

1. EU policy support consultant for Circular Economy incentive and Fertilizing Products Regulation (EU (2019)1009), DG Grow, JRC.
2. EIP AGRI and STRUBIAS (struvite-biochar-ash) work group member (JRC).
3. European Biochar Research Network (eBRN), Cost Action Biochar (TD1107), official national representative, cost.european-biochar.org (2011-2016).
4. European Sustainable Phosphorus Platform, phosphorusplatform.eu
5. TP organics Technology Platforms, tporganics.eu
6. BIOREFINE cluster, http://biorefine.eu, Interconnecting projects/people for nutrient cycling
7. NUTRIMAN platform https://www.nutriman.net
8. Member of EU Producer Organisation for fresh fruit and vegetable productions.
9. Member of EU Operational Group for upcycling of agri/food industrial by-products.

Priority working area:

Work field coverage: applied science and industrial engineering and agri/enviro commercial field applications. The three major – carbon related – work-fields:

1) **Carbon refinery**, thermochemical processing by zero emission and energy independent 3R technology for upcycling of carbon for wide range of natural and carbon negative product applications, most importantly biochar (all types). Reductive thermochemical science and industrial engineering, pyrolysis oil catalytic conversion and refining; activated carbon adsorbent manufacturing, qualified biochar production and applications; low carbon economy;

   Bio-formulation, biotech formulation of biochar/carbon for efficient bio and plant availability of nutrient uptake process support.

   Bio-energy, bio-oil processing for bio-energy production.

   Water treatment adsorber manufacturing and applications.
2) **Soil science:** plant available Phosphorous & Nitrogen recycling, soil biotechnology, solid state fermentation and formulation, drought tolerant cultivation methods, biochar carbon offsets.
3) **Climate change mitigation and adaptation,** carbon trading.

Core competence:

- **Phosphorous & Nitrogen recovery** and recycling, including **special core competence for ABC (Animal Bone Char) BioPhosphate, bone oil and all types of biochar production/applications.**
- Applied environmental scientific RTD in the fields of **zero emission pyrolysis processing**, biochar, nutrient recovery and energy generation processing with integrated and united approach of the advanced thermal-biotech-chemical S&T.
- Development of carbon negative reuse and economical applications of the market demanded recycled output products, most importantly biochar.
- Scale up, full scale industrial engineering and industrialization of zero emission performance reductive thermochemical processing (pyrolysis technologies) in any economical throughput capacity ranges.
- Agricultural, food industrial and urban organic waste stream resource added value conversion.
- Environmental and climate protection, carbon capture and mitigation, carbon offset markets.
- Reductive thermochemical conversion (pyrolysis) for processing of organic material (agricultural, food industrial, urban, industrial waste, clean coal processing), biochar biotechnological (solid state fermentation) formulation and soil applications, carbon based **resource and nutrient added value recycling** from the agriculture and food industry **(especially phosphorous and nitrogen** from food grade animal bone meal and other sources), **soil science.**

Edward Someus (CEO, recycling & upcycling engineer):

Senior Swedish environmental engineer (age 69). Education: University of Lund in Sweden 1972 - 1978, graduated in 1978, M.Sc., Natural and Environmental Sciences. Combining high level of scientific knowledge with industrial engineering and field applications, specializing in the: research, technical development, engineering, permitting, industrial applications and implementation of the zero emission carbon refinery, low temperature carbonisation and torrefaction technology, for recycling and reuse of carboniferous materials by integrated thermal/biotechnological means.

International leading scientific and industrial engineering expert in bio-waste and industrial scale biochar added value processing, valorization and reuse applications by pyrolysis and integrated biotech means for Phosphorous and Nitrogen nutrient recycling, enhanced food crop quantity and quality production, restoration of soil natural balance and pyrolysis by-product zero emission recycling. Specialized for EU policy and law harmonization development for Circular Economy.

REACH expert for chemically modified substances, with specialization on ABC Animal Bone Char, Animal Bone Oil and biochar. Edward Someus is member of the EU JRC/DG Grow work group for biochar and pyrolysis material EU law harmonization (2016-2018) and EIP-AGRI nutrient recycling WG.

Authority permit expert for full industrial scale permitting of innovative recovery technologies, including evaluation of environmental impacts, process safety, energetic efficiency.

Since 2002, Edward Someus has coordinated multiple international research and development programs (EU FP5, EUFP6, EUFP7, CIP-Ecoinnovation, H2020) in the specific field of carbon refinery and phosphorus recovery.

Edward Someus solely owns all the necessary intellectual property rights to all the key elements of the ABC-BioPhosphate and biochar manufacturing technology and its products. The 3R zero emission pyrolysis technology exploitation objectives are to enter the global market as biochar manufacturer and also as technology provider for licensed/franchised partners.

Specializing in the indirectly heated rotary kiln technique and auxiliary installations, such as off gas treatment and biofuel refinery, and **soil biotechnology**. Inventor of the 3R **zero emission carbon refinery** pyrolysis technology and carbon applications for soil improvements, including pyrolysis syngas processing and pyrolysis oil refinery, biochar solid state fermentation and formulation for enhanced and safe food crop productions.

Major EU Commission references (among several others):

NUTRIMAN: Nutrient Management and Nutrient Recovery Thematic Network (H2020 – RUR15 – contract no 818470, coordinator and key S&T tech designer, 2018-2021).
Role in the project: Coordinator, science and technology core work senior engineering.
Project status: ongoing in ten EU countries with 15 partners. https://www.nutriman.net

REFERTIL: Reducing mineral fertilisers and chemicals use in agriculture by recycling treated organic waste as compost and bio-char products. **Objective**: EU legislation support by definition of improved compost/biochar standards in the EU27. **Project website**: www.refertil.info
Project Duration: 48 months, **Starting date:** October 1, 2011.
Programme: European Union 7th Framework Programme (2007-2013), FP7-KBBE-2011.1.2-02
Role in the project: Coordinator, science and technology core work senior engineering
Contract/reference number: 289785, **Project status:** Successfully completed.
Project status: Successfully completed, follow up developments and high TRL scale ups made.

PROTECTOR, Contract Reference number: ECO/08/238984/ SI2.532247
Programme: CIP Eco-innovation, Project Duration: 48 months (2009-2012)
Role in the project: Coordinator, science and technology core work senior engineering, Phosphorous recycling. **Project status**: Successfully completed, follow up developments and high TRL scale ups made.

PROTECTOR - Recycling and upgrading of bonemeal for environmentally friendly crop protection and nutrition, **Project Duration:** 42 months (2005-2008).
Programme: European Union Sixth Framework Programme (2002-2006), Action: FOOD-2003-T6.6 Recycling and upgrading organic wastes from the food chain in environmentally friendly healthy food production. **Role in the project:** Coordinator, science and technology core work senior engineering. **Contract number:** FOOD-CT-2005-514082, **Project status:** Successfully completed.
Project status: Successfully completed, follow up developments and high TRL scale ups made.

TDT-3R MULTI FUEL - "Multi Fuel Operated Integrated Clean Energy Process: Thermal Desorption Recycle-Reduce-Reuse Technology". **Contract number:** EU FP5-NNE5-363-2001.
Project Duration: 36 months (2002-2005). **Programme:** European Union Fifth Framework Programme (1998-2002) - Energy, Environment and Sustainable Development specific programme. **Role in the project:** Coordinator, science and technology core work senior engineering.
Project status: Successfully completed, follow up developments and high TRL scale ups made.

Waste4Soil: Turning food waste into sustainable soil improvers for better soil health and improved food systems.
Objective: Waste4Soil envisions the development of 10 technological and methodological solutions for recycling food processing residues from the food industry into local, biobased circular soil improvers for improved soil health. A user-driven standardised Evaluation Framework will support stakeholders from the food value chain, including waste managers, to assess their status towards food processing residues circularity and take action for recycling suitable waste streams into beneficial soil improvers. **Project Duration**: 48 months, 2023-2027.
Programme: HORIZON-MISS-2022-SOIL-01-02, Contract/reference number: 101112708
Role in the project: Partner, Project status: ongoing

WALNUT: Improved resource recovery from the waste water cycle
Objective: Develop concepts and technological solutions to re-design the value and supply chains of nutrients from wastewater and brine. **Project Duration:** 72 months, **Starting date:** September 1, 2021. **Programme:** H2020 Societal challenges, CE-RUR-08-2018-2019-2020 - Closing nutrient cycles Contract/reference number: 101000752 Role in the project: Partner, Project status: ongoing

Nutri2Cycle: Transition towards a more carbon and nutrient efficient agriculture in Europe
Programme: H2020 - SFS-30-2017, SFS-30-2017, 2018 – 2022. Contract/reference number: 773682
Objective: Use an integrated approach to enable the transition from the current (suboptimal) nutrient household in European agriculture to the next-generation of agronomic practices, characterized by an improved upcycling of nutrients and organic carbon. Project duration: 72 months, Starting date: October 1, 2018. Role in the project: Partner. Project status: ongoing.

ECO-ZEO - Developing a pool of novel/eco-efficient applications of zeolite for agriculture sector
Project Duration: 48 months (2012-2016). Programme: European Union Seventh Framework Programme (2007-2013). Role in the project: Partner. Contract number: 282865, Status: successfully completed.

EUPHOROS - Efficient use of inputs in protected horticulture
Project Duration: 48 months (2008-2012). **Programme:** European Union Seventh Framework Programme (2007-2013), FP7-KBBE-2007-1. Role in the project: Partner. Contract/reference number: 211457, Status: successfully completed.

Few selected publications:

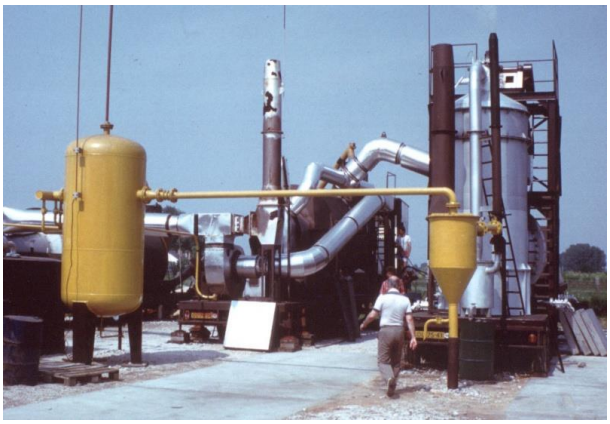
1) Edward Someus, Massimo Pugliese; Concentrated Phosphorus Recovery from Food Grade Animal Bones; Sustainability 2018, 10, 2349; doi:10.3390/su10072349, www.mdpi.com/journal/sustainability.
2) Edward Someus, Massimo Pugliese, Joeke Postma, Henning von Alten, Lea Lavric, REFERTIL–COMPOST AND BIOCHAR TESTING, BioRefine Bulletine, 2015 Issue 3.
3) J. Postma, F. Clematis, E. H. Nijhuis, E. Someus, Efficacy of four phosphate-mobilizing bacteria applied with an animal bone charcoal formulation in controlling Pythium aphanidermatum and Fusarium oxysporum f.sp. radicis lycopersici in tomato, Elsevier, Biological Control 67 (2013) 284–291, 19 July 2013, www.elsevier.com/locate/ybcon
4) Postma J., Nijhuis E.H., Someus E., 2010. Selection of phosphorus solubilizing bacteria with biocontrol potential for growth in phosphorus rich animal bone charcoal. Applied Soil Ecology, www.elsevier.com/locate/apsoil
5) G. P. Warren, J.S.Robinson and E. Someus, Dissolution of phosphorus from animal bone char in 12 soils, Nutrient Cycling in Agroecosystems, Volume 84, Number 2/ Jun, 2009, Springer Netherlands. http://www.springerlink.com/content/4876u47123372264/

Main aspects that are specific for the 3R Biochar natural product system:

Industrial scale capacities:	From 20,800 t/y throughput and up to any capacity
Environmental/climate performance:	Zero emission, full processing and utilization of all material streams (such as The Process of the Nature)
Environmental/industrial norms/standards:	European Union, Canada, Australia, USA,
Industrial operations:	Continuous >8000 h/y.
All types of biochar formulations:	Yes, as of specific user application market demand
ABC (Animal Bone Char) BioPhosphate (*carbo animalis*) **major and well proven application sectors:**	All types of natural - organic farming with main focus on horticulture – fruit and vegetable production.
	Forest nursery.
	Black pigment for artistic painting.
	Sugar refinery.
	Wide range of adsorbent use, water treatment, filtration, de-colorization, fluoride removal.
	Refine crude oil in the production of petroleum jelly.

What we do:

"The secret of success is to do the common thing uncommonly well." -- John D. Rockefeller Jr.
"We cannot solve our problems with the same thinking we used when we created them". (Einstein)



1995:

3R-v2 pyrolysis pilot

2023:

3R-v3 pyrolysis pilot scale, long term tested and operated since 2005 for wide range of different types of biomaterial carbonization treatment and pyrolysis oil refinery tests

Industrial production upgrade and TRL9 commercialisation with 2000 t/y and 20,800 t/y capacity is under investment organisation

Infrastructure and major equipments

3R-Biofarm Upcycling Centre in Kajaszo, West Hungary:

BIOFARM Upcycling Centre is situated in a fully permitted 30 ha agri-industrial site in Trans-Danubia, Hungary (Google Maps: https://goo.gl/maps/wHxmZ7J1ChJ2). The 3R-Biofarm Upcycling Centre is providing sustainable, safe, resilient & economical solutions and giving excellent place for different, yet complementary activities where our philosophy is fostering a relationship and reconnecting people to Nature.

Our main activities are related to the Phosphorus and nutrient recovery, biomass valorization, innovative agricultural biotechnology, renewable energy and water treatment. The core competence of the 3R-Biofarm Upcycling Centre is the **ecological recycling and added value reuse of unexploited biomass by specific and advanced high temperature 3R Zero Emission pyrolysis and biotech means and production of biobased fertilisers and adsorbents.**

The 3R-Biofarm Upcycling Centre operates a specific **Biogarden which is established as a model garden for presenting and introducing circular, sustainable and self-sustaining organic plant and animal husbandry** in practice. This Biofarm Garden also provides demonstration activities for several EU-funded projects.

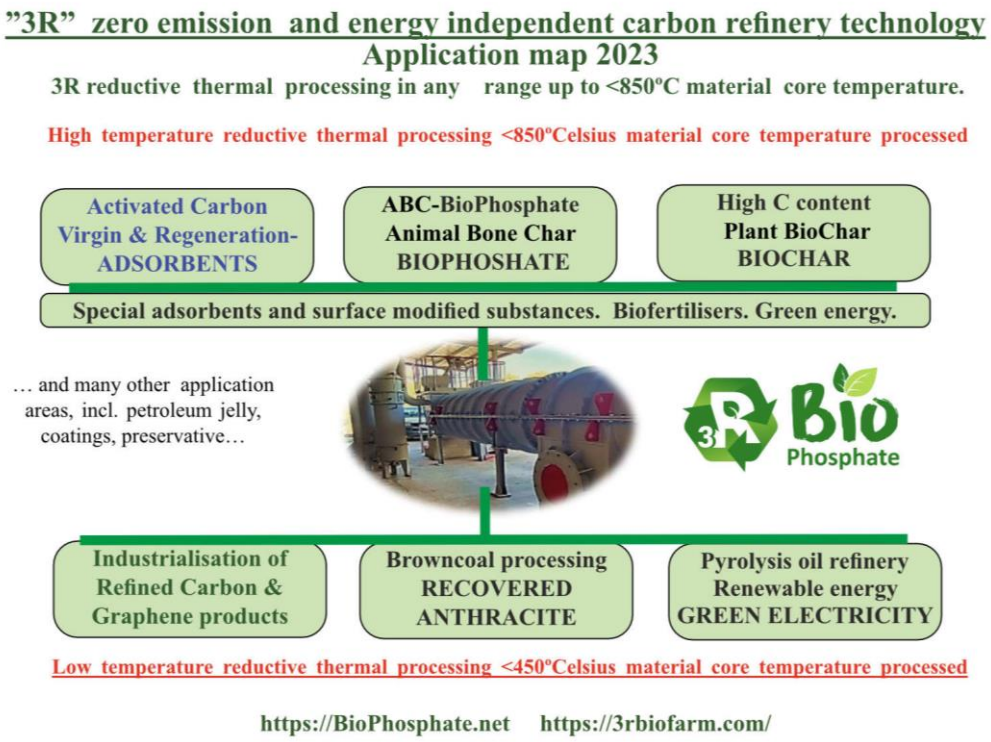
This industrial site in West Hungary is dedicated to innovative and advanced agricultural, environmental and industrial technology field demonstrations for preparation of scale up operations and training of the applied RTD results the field of renewable energy, biomass valorisation, which is a transfer station from science into industry.

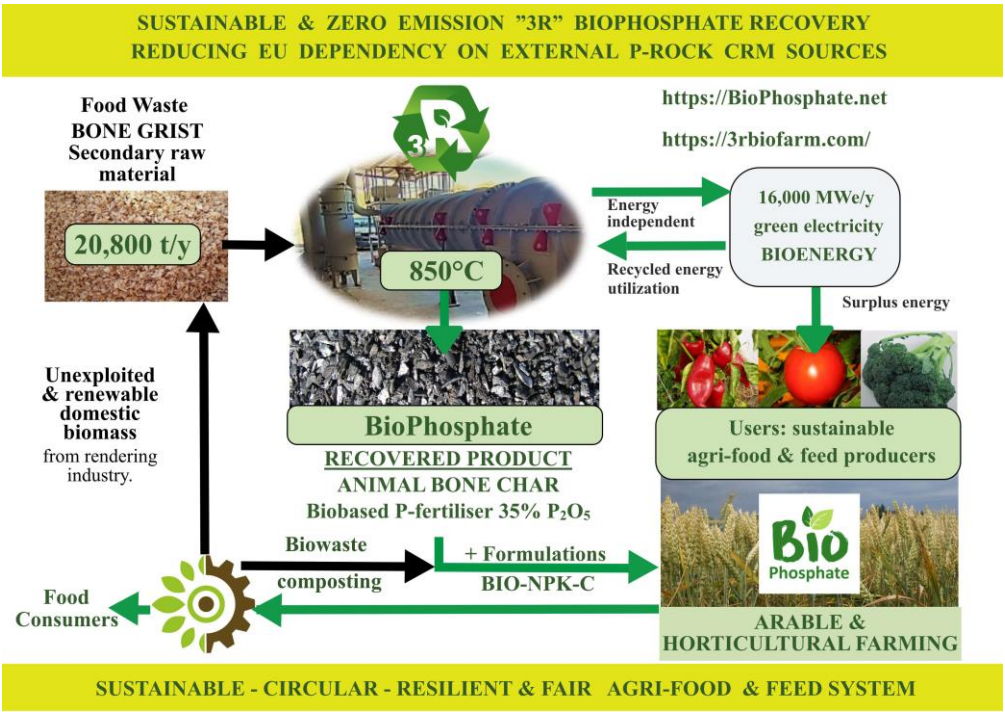
The Biofarm facility is providing a unique **testing and demonstration facility** for agricultural applied research and demonstration actions in 30 ha area to scale-up innovative agro-ecological and organic practices.

Objective: conversion of innovative science into market competitive industrial practice. The Biofarm is Authority permitted demo site for TRL7-TRL8-TRL9 actions.

The main units:

1. The full equipped **agro biotech laboratory** installation is specialized for fungus with any biotech operations and capacity up to 150 litre fermentation capacity:
   - Microbiological laboratory
   - Available: 3x5 litre, 12 litre and 2 x 150 litre professional liquid fermentor systems, supported by complete and comprehensive microbiological laboratory) for microbiological inoculums production.
2. **Pyrolysis center:** Three different scales of pyrolysis equipment developed for material treatability and equipment/method product like testing: (1) laboratory test (1 kg batch), (2) pilot test rotary kiln (10 kg/h batch). (3) TRL6 Field demo test (200 kg/h continuous).
3. **Agri training, international conference and webinar center** for 125 visitors to combine theoretical presentations with practical on-site show up to convert theory into practice. The conference center is also prepared to make live broadcasting in multiple languages, in case of digital connection is considered safer.


"3R" zero emission and energy independent carbon refinery technology
Application map 2023
3R reductive thermal processing in any range up to <850°C material core temperature.
High temperature reductive thermal processing <850°Celsius material core temperature processed
Activated Carbon Virgin & Regeneration- ADSORBENTS
ABC-BioPhosphate Animal Bone Char BIOPHOSHATE
High C content Plant BioChar BIOCHAR
Special adsorbents and surface modified substances. Biofertilisers. Green energy.
… and many other application areas, incl. petroleum jelly, coatings, preservative…
Bio Phosphate
Industrialisation of Refined Carbon & Graphene products
Browncoal processing RECOVERED ANTHRACITE
Pyrolysis oil refinery Renewable energy GREEN ELECTRICITY
Low temperature reductive thermal processing <450°Celsius material core temperature processed
https://BioPhosphate.net https://3rbiofarm.com/


SUSTAINABLE & ZERO EMISSION "3R" BIOPHOSPHATE RECOVERY
REDUCING EU DEPENDENCY ON EXTERNAL P-ROCK CRM SOURCES
Food Waste
BONE GRIST
Secondary raw material
20,800 t/y
850°C
https://BioPhosphate.net
https://3rbiofarm.com/
Energy independent
Recycled energy utilization
16,000 MWe/y green electricity BIOENERGY
Surplus energy
Unexploited & renewable domestic biomass
from rendering industry.
BioPhosphate
RECOVERED PRODUCT
ANIMAL BONE CHAR
Biobased P-fertiliser 35% P_2O_5
Users: sustainable agri-food & feed producers
Biowaste composting
+ Formulations BIO-NPK-C
Food Consumers
Bio Phosphate
ARABLE & HORTICULTURAL FARMING
SUSTAINABLE - CIRCULAR - RESILIENT & FAIR AGRI-FOOD & FEED SYSTEM